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XXXIV.—*On the British* Tritons.

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[With two Plates.]

These observations are the result of an unremitting attention to the natural history of the *Triton* during five years.

Regarding the physiology of each individual species of animal as a type and example of physiology in general, I imagine that the science would not be advanced more certainly than by an undivided investigation of one, and that a most interesting example.

My steps have been guided by the works of Dr. Rusconi and Professor Bell, and the following observations will be found curtailed or extended, as I imagine I have arrived at the same results as these two authorities have done, or added some new facts or views to what was previously known.

As the result of my observation, I may premise that I have not been able to find more than two species of Triton in the midland counties of England; that these, produced in water, are furnished in a peculiar manner with respiratory organs, first for aquatic respiration, and in the second place for atmospheric respiration; that after leaving the water they chiefly remain inhabitants of the land and breathe atmosphere for no less a period than three years uninterruptedly, passing through changes and states in their slow growth, which have misled naturalists into the opinion that there are more species than really exist; that at the expiration of the third year the animal in its mature state betakes itself for a second time for a season to the water, but solely for the purpose and during the period of reproduction; and that this view of the subject, the result of long and assiduous

observation, is singularly confirmed by the facts of the anatomical structure, viz. that the male Triton has no appearance of crest, silvery stripe on the tail, fringe or membrane on the hind toes, during the first and second year; and the testes and ovaries are of a very diminutive size, facts to be noticed more particularly hereafter.

The principal questions which I purpose to notice are—

1st. The determination of the number of species of Triton in the midland counties of England.

2nd. The fecundation, deposition, and bursting of the ova.

3rd. The development of the Tadpole and the perfect animal.

4th. The uninterrupted extension of its terrestrial life through three whole years in a state of activity in the summer, and in a state of hibernation in the winter season.

5th. The limitation of its second aquatic life to the period required for reproduction.

6th. Certain peculiarities in its anatomy.

I. *On the Species of* Triton.

During my long observation of the *Triton* in the pools of the midland counties and their clayey banks, &c. &c., I have not been able to detect more than two species; one of them is that termed the common warty Triton, and the other is designated the common smooth Triton. But these two species of the Triton present such varied appearances during the three years of their slow but progressive growth, and during the changes they experience preparatory to their return from being inhabitants of the land, breathing atmospheric air, active in the summer and hibernant in the winter, to being active denizens of the water, reproducing their kind in the months of March, April, May, June and July, that I think they have been regarded by naturalists as presenting too great a number of distinct species.

The crest, from which one species has received the designation of *cristatus,* and the fringe or membrane, from which another has received that of *palmipes,* are not permanent adjuncts, but exist only during the active season of reproduction, and only in the male. These appendages are scarcely therefore admissible as characteristics of the species of Triton. I would venture to propose as permanent and descriptive names, which I shall take the liberty of making use of in this paper, the terms *Triton asper* and *Triton lævis*; in fact, the large Triton is at all times distinguished by its rough granular skin, whilst the smaller is always known by its smooth surface.

The terms aquatic and terrestrial are not more applicable, as I am enabled to say, that no species of Triton is exclusively

either terrestrial or aquatic, but that both are equally aquatic in their early tadpole stage and in their later and reproductive life, and equally terrestrial in the long intermediate period.

Cuvier himself observes, in a note subjoined to his description of the various species of Triton:—"Cette caractérisation des espèces européennes est celle qui m'a paru le plus conforme à la nature, mais il me serait très-difficile d'y rapporter exactement la synonymie des auteurs, tant je trouve leurs descriptions et leurs figures peu d'accord avec les objets que j'ai sous les yeux*."

II. *The Fecundation, Deposition, and Bursting of the Ova.*

From minute observations of the process of fecundation in the pools where the Triton abounds, I am led to conclude that this takes place internally through the medium of water, without the immediate contact of the sexes.

The protuberances on each side of the cloaca in the male are very prominent during the breeding season.

The protuberances and the villous enlargement also around the cloaca in the female, exist in this prominent condition only during that period.

The ova begin to be deposited as early as the beginning of April, and continue to be deposited as long as the first or second week in July.

If a plant with long leaves be thrown into a pool where there are Tritons for only a single night during the breeding season, it will be found on the following morning to have a number of its leaves folded, and within each fold an ovum.

For the successful development of the ova, it is necessary generally that they should be deposited and enclosed within the folded leaves of some living aquatic plant. If they are placed at the bottom of a vessel, or merely on the surface of a leaf exposed to the water, they usually perish at an early period.

For this purpose some aquatic plants are much more suited than others, the best being those which have some firmness of fibre. I have seen some ova laid on the water dock, which it has required the little animal to exert very strong pressure to double; this, however, it has effected at length by breaking the firm fibres of the plant.

I have found that some aquatic plants are too pliable and soft, as the *Nasturtium aquaticum*. Not having sufficient fibre to preserve the ova the fold is not permanent, so that the ova become too much and too early exposed to the water, and they perish. The most favourable plants I have observed for the deposition of

* Règne Animal, t. ii. p. 117.

the ova are the *Veronica anagallis*, and the long grasses which abound in some pools.

The *Veronica anagallis* has a firmer leaf than the *Nasturtium aquaticum*, is formed into firmer folds, and is thus better calculated for enclosing and protecting the ova. The long grasses appear still more favourable for this purpose, and are best suited for the security of the ova; they admit of four or five or more of the ova being deposited singly in folds on a single blade. Each ovum is generally placed in the centre of that part of the blade on which it is laid, and is neatly covered within a fold in such various directions as frequently to present a fantastic appearance, when the whole or the greatest part of the blade is folded. Almost any aquatic plant serves as a receptacle of the ova. I have seen them deposited even within the linear leaves of the *Ranunculus aquaticus*, so compressed as to secure the ova.

The Triton, when depositing its ovum, first rests with the lower part of the body across a leaf or blade of grass; this it folds up by means of its posterior extremities, making repeated acts of pressure with them until the fold is sufficiently complete to admit of the secure insertion of the ovum; when that is accomplished the posterior extremities are pressed together upon the enclosed ovum for a minute or more, when the little animal quits it to deposit another ovum. The ovum when first deposited is round and has a small white yolk in its centre, which has no attachment within its envelope, but is surrounded by an aqueous fluid, within a firm transparent capsule.

A soft jelly-like substance covers the surface of this capsule, which materially assists by its adhesive property in securing the ovum and preserving it from too great exposure to the water, an event which at an early period often destroys its vitality, in which case it is seen to become covered with mould. In about a fortnight the ovum becomes so large as in some degree to sever itself from the fold of the leaf, and some parts of the ovum now come freely in contact with the water without injury; indeed, the free exposure to the water appears necessary for its further development. By the experiment of putting some ova into water coloured with saffron for a short time, it will be found that they exhibit an appearance of little golden balls, and by removing them afterward into clear water for a time, they become colourless, proving that there is a constant endosmose and exosmose through each ovum, so that there is a constant supply of fresh water for the preservation and further development of the embryo.

The safety of the ovum depends also, at an early period of its development, upon the integrity of the leaf on which it is deposited, as I have already stated, for when this is much broken in folding, when the plant is too delicate of fibre, or from other

causes, the ovum becomes exposed to the water too early and perishes.

About a week after the ovum has been deposited, the embryo acquires more of an oval shape; in another week it increases in size, and the head, body and caudal extremity are seen distinctly through the transparent capsule which gradually increases in size; in about three weeks the embryo is perfect and beautifully formed, and moves quickly round within its envelope, which is now much distended.

About this period the tadpole escapes from the capsule, when in water freely exposed to the open air, but its development is modified by circumstances, such as situation, temperature, &c.

I kept some ova in a room with a south aspect at 60° Fahr., and the tadpoles escaped in fourteen days. I placed other ova, which were deposited on blades of grass, in a deep, dark, rock cellar, at 48° Fahr.; they were fully developed in these in three weeks, the same time as some others placed in the open air at 55° Fahr.; but after quitting the ova, the growth of those tadpoles in the cellar was materially impeded; the facts of which are given in my paper "On the Influence of Physical Agents on the development of the Triton and Frog," published in the Philosophical Transactions, Part 2, for 1850, p. 431.

III. *The Development of the Tadpole and the young Animal.*

At length the ovum bursts, and the tadpole escapes and swims freely away; it rests or suspends itself on the edge of a leaf, or on a blade of grass, or on the oblique sides of the vessel. It sometimes remains on the bottom of the vessel, lying on one side, as if inanimate or unable to sustain itself, but on being disturbed it quickly swims away.

Shortly after the tadpole quits the ovum it feeds voraciously on aquatic larvæ, animalculæ and small animals in the water. I have seen the *Triton asper* in its branchial state with three of the smaller species in its stomach at one time. The Triton remains in the water in the tadpole or fish-like state until its branchiæ disappear and its legs become sufficiently strong to enable it to quit this element. The development and growth of the legs is very tardy; the anterior extremities are about twenty-one days in being formed after quitting the ovum; the posterior about ninety days, and they are then extremely fine and delicate; but as the legs become stronger, the branchiæ gradually disappear and the opercula close over the gills. When these changes are accomplished, the animal leaves the water and becomes entirely terrestrial. This occurs generally in September, between the first and last week in that month; but to this rule there is an exception, which I first observed in October 1845, on examining some pools where Tritons of both species abound

during the summer season. I found a *Triton asper* in the tadpole state, with large branchiæ and an expanded tail. I kept it in a glass globe in the open air in water (in which were aquatic plants) during the winter months, and found that it retained the branchiæ until the succeeding February, when it died. The following month (March) I had brought to me two tadpoles of the smooth species in the same condition, with the persistent branchiæ and expanded tail, and on searching a pool where this species particularly abounds I found several others. I perceived that these could not be of that season's growth, for at this period the full-grown Tritons had not come to the water, the breeding season not having commenced. I considered that these tadpoles must be the produce of the ova deposited late in the former season, as in June or July; and this view I think was corroborated by their branchiæ disappearing in June, nearly three months earlier than in those produced from the ova deposited in the spring. These observations appear to prove that the Triton does not grow during the winter, and that in genial weather, between five and six months are required for the tadpole to arrive at its full development.

IV. *The uninterrupted extension of terrestrial life through three whole years, in a state of activity in the summer and in a state of hibernation during the winter season.*

I think the young generally travel a greater distance from the water than the older ones, and do not, like them, assemble and become coiled together. They are often found in damp cellars, old wells and similar places, and under flat stones, and sometimes deep in the earth, single, and far remote from any pools or water. It is from this circumstance I imagine, and from their long continuance out of water, that in Britain a terrestrial species of Triton has been supposed to exist by some naturalists, and is often called by the common people *the ground newt*. The Triton does not commonly return to the water until the expiration of the third year, when they are so far advanced towards maturity as to be able to reproduce their kind.

It was not until the third year of my investigations that I could account for the different sizes of the Triton existing at the same period of time. At the end of March I found several of the *Triton asper* in holes under the embankment of a pool, the least of them not quite 2 inches in length; and a few days afterwards, that is, in the first week of April, I took out of the water the full-grown Triton nearly 6 inches in length and beautifully crested. On carefully comparing those of the smaller size with some which I had kept during the winter, I perceived that they corresponded with those of one year's growth. On examining and comparing others, I found that there were two

intermediate sizes, so that I was led to the conclusion that the full-grown Triton of three years' growth is partially crested, and that the fully-crested Triton is four years in arriving at this perfect size and state: growth is arrested during hibernation.

During two years of repeated visits to the pools, I did not observe a Triton of the first and second year's growth in the water. During the third year I found none of the first year's growth, and only two of the second year's in the water; the appearance of these I was compelled to look upon as accidental. It seems probable that if the Triton of one year's growth should find its way into the water, it would presently fall a prey to the larger ones, which are very voracious during the breeding season.

The *Triton asper* at the close of one year is about 2 inches in length; the colour of the body is of a blackish brown, slightly rough, with minute spots of white, the breast and abdomen being of a light yellow, sometimes with small dark spots (Pl. XV. fig. 1.)

At the close of the second year this Triton is now more than 3 inches in length, varying little from that of the first year, except in having more dark spots on the abdomen, and sometimes a yellow line extending along the middle of the back to the tail: the sexes are scarcely to be distinguished externally (fig. 2).

At the end of the third year it is 4 inches in length, the skin on the body has become rougher, the breast and abdomen more of an orange colour, and marked with large irregular spots. In the male, during the breeding season and for the first time, there is an indented dorsal crest, and a dark-coloured protuberance on each side the cloaca is observed. The tail (which during the two former years, when terrestrial, was more compressed) becomes now more expanded, and is marked on each side with a silvery stripe, which is persistent. In the female there is an oval raised villous appearance round the cloaca, and the tail is also more expanded (fig. 3).

At the expiration of the fourth year the *Triton asper* is between 5 and 6 inches in length, and the chest and abdomen are of a still deeper orange colour, and marked with dark irregular spots; the male has its full-grown dorsal crest, the tail is still more expanded and of a lanceolate form; and in the female, the protuberances on the sides of the cloaca are larger, and the raised villous appearance is still more apparent than before. The female is usually larger in size than the male (fig. 4).

The generic characters of some Tritons have been distinguished by the upper lip overhanging the lower. I have observed, that in the first year's *Triton asper* the upper lip overhangs the under considerably at the sides. In the second year it overhangs less. Between the second and third year it becomes straighter, and in the fourth it overhangs again as much as in the first year. This

is also very evident in the *Triton lævis*, in which the same changes take place.

In winter the full-grown Triton is often found in the immediate neighbourhood of those pools to which they resort in the spring.

The average weight and length of the *Triton asper* as taken from eighty in number, found in the crevices and holes in the neighbourhood of the pools in September 1846, are as follows:—

First Year's Triton.

LARGEST.	SMALLEST.	AVERAGE.
30 grains.	20 grains.	25 grains.
$2\frac{1}{2}$ inches.	$1\frac{3}{4}$ inch.	$2\frac{1}{6}$ inches.

Second Year's Triton.

70 grains.	46 grains.	54 grains.
4 inches.	$3\frac{1}{4}$ inches.	$3\frac{1}{2}$ inches.

Third Year's Triton.

90 grains.	60 grains.	75 grains.
$4\frac{3}{4}$ inches.	$3\frac{1}{2}$ inches.	4 inches.

Fourth Year's Triton.

180 grains.	120 grains.	134 grains.
6 inches.	$4\frac{3}{4}$ inches.	$5\frac{1}{4}$ inches.

(See Plate XV. figs. 1, 2, 3, 4.)

A similar computation might be made of the *Triton lævis*.

There is a general meeting *of all ages* of the Triton in August and September, before the period of hibernation. It would be useless to attempt to find them at any other time of the year.

In the summer the Tritons of both species are found in abundance in the pools of old brick-yards. The brickmakers, who are constantly disturbing the water and removing the clay, and who occasionally clear the bottoms of the pools, state, that they never find any Tritons in the water during the winter months, but they discover great numbers of them in holes in the clay, and sometimes ten or twelve coiled together.

I have already stated that I have not been able to find any in the pools during the winter, except the branchiated ones beforementioned. To test the accuracy of the opinion and to obtain further knowledge of the habits of the animal, I made the two following experiments:—First I procured a large earthenware vessel (a foot-bath) eight inches in depth, in one part of which I placed pieces of dry clay and some flat stones to the height of six inches, whilst on the other side I placed some moist clay and poured water upon it to the depth of two inches, and thus

arranged a watery and an earthy place of abode for my Tritons. I put a number of these into the water. In a short space of time they all left it and crept into the crevices above and under the stones, and there remained in a state of hibernation during the whole of the winter. About a fortnight afterwards (on the 23rd of October, 1843), I tried a second experiment which I thought would be still more conclusive:—I obtained a large long cylindrical glass vessel; in the centre and at the lowest part of this I secured a piece of pumice-stone with common cement; around the base of the stone I put some soft clay and poured in rain-water to the depth of three inches, leaving the upper part of the pumice-stone uncovered. About three inches above the water I arranged pieces of wood across each other in the form of latticework, supporting it by small wooden pillars, and leaving holes large enough for the animals to creep through, and I placed an inclined plane of wood with notches so as readily to allow them to ascend to the latticework if so disposed. I put twenty Tritons into the water below, and placed clay and some irregular flattened stones upon the latticework to the height of six inches. The top of the vessel was secured by means of muslin. The Tritons found their way in a few hours from the water through the latticework into the crevices and holes formed by the clay and stones; two indeed more bulky than the rest were some time in attaining this object, but these succeeded ultimately. They remained in this situation of comparative dryness during the whole winter, except that one or two occasionally dropped through a crevice into the water. On one occasion, about Christmas 1843, the sun had during two or three days considerable power, and in the afternoon of the 24th December I observed two bats flying about some old buildings in a neighbouring village. On the same day I observed that the Tritons in the glass were restless, and that several of them descended and bathed their tails in the water, but I did not see them go into it; they soon regained their former situation, where they remained in a state of hibernation till the following spring. I have observed that either a very wet or very dry situation is fatal to the Triton during its state of hibernation, and that a moderately damp one is always chosen for that state of existence.

In the autumn of 1843 a considerable number of Tritons escaped during several *wet* days, from two large earthenware vessels which I had placed in a garden upwards of thirty yards from my house; some of these were found in an adjoining garden, but several months afterwards, on the 2nd of December, eleven (nine of the *Triton asper*, and two of the *Triton lævis*) were discovered coiled together behind and under a broken brick at the further end of a deep rock cellar. They had thus found

their way through a grating which led to the cellar in an irregular course twenty-six feet deep and nearly perpendicular.

The cellar was sufficiently damp to prevent evaporation and to continue the cuticular absorption, for they were all plump and healthy; but having been afterwards put into a small white glazed jar and left in a room from 55° to 60° Fahr. and forgotten, they were found dead in a desiccated state after the lapse of three or four days.

Another accident occurred to a number of the Tritons which I had kept exposed to the weather in a large vessel with clay and stones. There had been a continued rain for several days, and they had from this cause become covered with water whilst in a state of hibernation. I found them all dead and swollen, whilst others which had not been exposed to the rain were in a healthy state.

I have, in two experiments, found that the Triton can live in a solid mass of ice, without injury, as has been noticed by naturalists.

In Feb. 1844 I put two Tritons into some water in a vessel and exposed them to a freezing temperature during the night; in the morning I found the water frozen very firmly, with the Tritons enclosed in its centre. On thawing they were lively and flexible; not in the same condition which occurs during hibernation, for when in that state I have found them comparatively stiff, with the body bent in various shapes, and with the tail partly curved, and on being put into the hand (at 80° Fahr.) they twist the body, and the tail becomes more curved.

In the second experiment there was a piece of ice at the bottom of a circular vessel. I placed two Tritons upon it and then another covering of ice, and filled the vessel with water. I exposed it during the night in the open air at the temperature of 28° Fahr. In the morning the whole had become a solid mass of ice, twelve inches in circumference, with the animals in the centre.

On breaking the ice carefully they were found completely encased in the ice. I had some difficulty in separating one extremity, but being liberated it used its arms and legs equally well.

V. *Limitation of its second aquatic life to the period required for reproduction.*

About the last week in March the perfect Triton leaves the land and again becomes aquatic. It has then acquired all those appearances which exist only during the breeding season.

The mode of fecundation in the *Triton asper*, from my own observation, accords with that of Dr. Rusconi, in his work en-

titled 'Les amours des Salamandres.' I will however add a very succinct account from my own observation.

I believe fecundation takes place in the Triton internally, although effected without immediate contact of the sexes. The male pursues the female with perseverance until the latter stops; he then remains with his head inclining to the head of his mate and commences waving his tail for a minute or two, and at intervals with a quicker motion. He then turns upon his side, sometimes with the tail quite erect for a few seconds; these motions are continued for several minutes; when he makes a smart motion with his tail similar to the smack of a whip in a direction towards the female, but without immediate or actual contact; the male then swims away, but the female remains stationary for a short time and then goes away in another direction.

The male *Triton lævis* differs somewhat from the *Triton asper* in the process of fecundation; his tail is bent forwards in the middle and remains in that position, whilst the end has an exceeding quick vibratory motion, the female remaining still by his side.

The full-grown Triton feeds on live aquatic animals, which it is capable of swallowing whole, and the power of retaining the prey when once seized is remarkable. I have often seen a Triton seize on the end of the delicate tail of the tadpole of the frog, and with that slight hold it has drawn the whole body of the tadpole into its gorge. The Triton also feeds upon the *Limneus pereger* and other mollusca, and it is not uncommon to observe in the stomach and intestines from ten to twelve of these mollusca of different sizes. These distend the intestines, near the lower part of which the shells are found nearly empty. When voided some of the shells are observed to be broken, others are entire, but quite empty. Some of the *Triton asper* I found in the pools late in the season were quite gorged with the young of the smooth species, and I have seen them devour the young of their own.

The digestive power of the Triton, when inhabiting the water, is very great, for in three days after it has been gorged with the tadpole of the frog, the stomach and intestines are found nearly empty.

On the other hand, some Tritons which I kept from September to March without food, after being in a state of hibernation in a damp situation for so many months, did not appear emaciated.

About the first or second week in July, the crest and the other peculiarities which they had acquired preparatory to the breeding season disappear both in the male and female; this process of absorption takes place rapidly, and afterwards they are no longer induced to remain in the water; so that early in the month

of August there is a visible diminution of the number in that element. I have seen some as late as the middle of August, and but rarely in the beginning of September.

In the middle of August I have procured a number of both species from crevices and embankments, whither they have retired until the next breeding season.

VI. *Peculiarities in the Anatomy of the Triton.*

In the tadpole state the Triton is furnished with no less than four distinct organs for respiration: 1st, the gills; 2nd, the branchial fringes; 3rd, the lungs; 4th, the cutaneous surface and expanded tail and crests.

The gills form three perfectly distinct semilunar arches immediately beneath the operculum on each side.

The branchial fringes extend and float externally so as to admit of the circulation being readily observed under the microscope, and each loop is continued along one of the semicircles of the gills.

In addition to these forms of respiratory organs, the lungs are visible on opening the general thoracico-abdominal cavity. These contain air from their earliest period. It is obvious that the lung will answer the purpose of the air-bladder in fishes. I have repeatedly observed that the tadpole is at one time of rather less specific gravity than water, rising to and remaining at the surface without effort, and at other times of rather greater specific gravity than that fluid, falling to the bottom of the vessel in the same manner.

I scarcely need make any observation on the cutaneous surface as a respiratory organ.

The blood circulating in the expanded tail and crests is almost as much exposed to the respiratory medium as that in the branchial fringes themselves.

As the period for quitting the water approaches, the branchial fringes disappear and the opercula closely adhere over the gills, which also disappear in their turn.

The other peculiarities of the anatomy of the Triton relate to its resumption of the water, and to its new function of reproduction at the spring of the fourth and subsequent years. The crest in both species of the Triton, and the fringe or membrane in the posterior extremities of the *Triton lævis*, undergo a rapid development in the months of February and March. They are obviously destined to enable the animal to move about rapidly in its native element and assist in aquatic respiration (Pl. XVI. fig. 5).

In the month of June these adjuncts begin to disappear, and by the middle of July the crest, &c. remain only in the form of mere ridges (Pl. XVI. figs. 6 & 7).

In all other ages and periods the crest and the fringe or membrane are absent, affording a perfect proof that the observations which have been made respecting the protracted terrestrial life of these animals are correct. No Tritons of the sizes denoting the different ages between the tadpole state and the completion of the third year possess either crest, fringe or membrane, or silvery stripe along the tail, as observed in the male.

But the most striking point of the anatomy of the Triton is that which I proceed to notice; there is not, until the completion of the third year, a full development of the testes in the male, or the ovaria in the female.

The Triton, from the first appearance in the tadpole state to the completion of the second year, has no external appearance of sex, except in the male a slight dark appearance in the situation of the cloaca, which requires minute observation; and internally the testes and ovaries are of a very diminutive size, the testes being not much larger than a coriander seed in the second year, and the ova bags but just discernible.

From the second to the third year all the signs of the male and female are rapidly developed, and they are matured at the lapse of three years, just at the period when the animal returns, as I have stated, to its pristine element.

I may here state, that during the winter when the Triton is in a state of hibernation, both the lungs and stomach are frequently found empty.

The cutaneous surface is sufficient for the low degree of respiration required in this state, and the processes of digestion, assimilation, &c. are equally in their lowest degree, and are in accordance with a general law.

Like some other hibernating animals, the Tritons of the third and fourth year are found during the cold season in the earth under stones, in clusters of the magnitude of a cricket ball.

Those of an earlier period are often found singly at a greater depth under the earth as before stated.

Observations on a new species of British Triton.

In April 1848 Dr. Buckland, Dean of Westminster, informed me of a new species of *Triton*, and referred me to Mr. Baker of Bridgewater for information.

On writing to that gentleman he very kindly sent me some specimens, and in July following directed my attention to a paper on the subject in the 'Zoologist' (Zool. 2149) by Mr. Wolley of Edinburgh. In the following month another paper appeared in the same periodical by Mr. Baker of Bridgewater, and a third in September by M. Julian Deby, in which the little animal is

designated the *Lisso-triton Palmipes,* and a description is there given which agrees with the observations of the two former gentlemen.

Mr. Baker was the first person who discovered the new species in England in 1843, and Mr. Wolley the first in Scotland in 1848.

By the kindness of these two gentlemen I obtained more than one hundred of these Tritons, male and female. I put them into a pool which I made for the purpose in a secluded spot in a garden, which I supplied with aquatic plants, and surrounded it with clay and stones as a retreat during hibernation.

I closely observed their habits and their periodical changes during two years, and found them the same as in the *Triton lævis.*

The characteristics of this Triton are, according to M. Deby, in the male—1st. Tail suddenly truncate before the apex, and terminating in a slender filament 3 lines in length; 2nd. Hind feet perfectly palmate, all the toes united by a membrane; 3rd. The dorsal crest small and simple; 4th. Size much smaller than the *punctatus* (Pl. XVI. fig. 8).

I have fully ascertained the changes when the breeding season is over. The slender filament is absorbed, and the truncated portion of the tail becomes obtusely rounded off with a slight indurated dark tip at the end, and the web on the hind feet is wholly absorbed, leaving the toes free (Pl. XVI. fig. 9).

Being the smallest of the Tritons, it may be designated, I think with great propriety, *Triton minor.*

I would propose as a new nomenclature for the three Tritons now *fully* recognized in Great Britain—1st. The *Triton asper*; 2nd. The *Triton lævis*; 3rd. The *Triton minor.*

I would here remark, that my observations have led me to the conclusion that there is only one genus of the Triton. The rough skin of the one species and the smooth skin of the other does not appear a sufficient difference to form another distinct genus, their habits are all alike, and the variety of their changes are also the same.

The Tritons left my pool between the 11th of August and the 4th of September, and I found them under large leaves growing near the pool, having undergone their changes for terrestrial life and for subsequent hibernation.

I had also in this locality an opportunity of corroborating my former statement, that the tadpole of the Triton requires five months at least of genial weather before it arrives at its full development so as to be able to leave the water; the tadpoles produced from the ova deposited in the month of July remain in the water through the winter, apparently undergoing no change,

and only become fully developed in May and June, at which time they leave the water. This fact can only be proved satisfactorily in those pools where there are only the *Triton lævis* or the *Triton minor*; if the *Triton asper* were in the same pools, the tadpoles would fall victims to their voracity before they arrived at their full development.

During several unusually mild days at the latter end of December 1850 and January 1851, I saw that three of the full-grown Tritons had left their place of hibernation and were in the shallow part of the pool; they only remained there a few days.

In conclusion I have endeavoured to prove—

1st. That there are only two species of Triton in the midland counties of England.

2nd. That the tadpole of the Triton remains in the water until the branchiæ are absorbed and the legs become sufficiently strong to enable it to leave that element, and does not usually return to it again until the expiration of the third year.

3rd. That during three years it is a land animal, in a state of activity in the summer, and of hibernation during the winter.

4th. That the Triton is three years before it propagates its species, and four years in arriving at its full growth.

5th. That it revisits the water in the spring for the purpose of reproduction and leaves it early in autumn.

6th. That fecundation is accomplished through the medium of water, and not by actual contact.

7th. That a very dry or a very wet situation are both fatal to the Triton when in a state of hibernation.

8th. That the habits and changes of the new Triton are in accordance with the other species.

Nottingham, Oct. 14, 1853.

EXPLANATION OF PLATES XV. and XVI.

Figs. 1 & 2. *Triton asper* of the first and second year's growth.

Fig. 3. The male *Triton asper* of three years' growth during the season of reproduction, with a small crest and a persistent silvery stripe on the tail.

Fig. 4. The male *Triton asper* of four years' growth during the season of reproduction, with a full crest and expanded tail of a lanceolate shape.

Fig. 5. The male *Triton asper* of four years after leaving the water preparatory to hibernation, the crest and the expansion of the tail being absorbed.

Fig. 6. The full-grown male *Triton lævis* during the season of reproduction, with crest and fringed hind toes.

Fig. 7. The full-grown male *Triton lævis* after it quits the water, preparatory to its hibernation, destitute of crest and of the fringe on the hind toes.

Fig. 8. The full-grown male *Triton minor* during the season of re-

production, with a small crest, webbed hind feet, and a slender filament at the extremity of the tail.

Fig. 9. The full-grown male *Triton minor* after leaving the water, destitute of crest, web on the feet, or slender filament on the tail, all having been absorbed.

XXXV.—*Notes on some new or little-known Marine Animals.* (No. 3.) By P. H. Gosse, A.L.S.

Class CRUSTACEA.

Fam. Crangonidæ.

Crangon spinosus (Leach). The Spinous Shrimp.

A specimen brought me Sept. 1st is slender as compared with *C. sculptus* and *fasciatus*. Its ground colour is drab or pale wood-brown, with a defined band of opake white across the fourth segment, a much broader one across the front of the carapace, and an irregular broad white band running down longitudinally on each side, so as to unite these two, leaving an oblong mark of drab insulated in the middle; a broad band of which crosses the tail-plates. The under parts of the body and the legs are spotted with crimson.

Crangon trispinosus (Hailstone). The 3-spined Shrimp.

This species was not uncommon early in June in Weymouth Bay, but ceased to occur from that time until the end of August, when half a dozen were again dredged. Some of them were an inch and a half in length. Their colour consists of a vast number of ruddy-golden stars closely set, interspersed with black and pale specks, on a pellucid grey ground. On the fourth abdominal segment there is a speck of pure opake white, in the median line, near its hind edge: this speck, though occasionally obsolescent, appears to me to be so constant as to be characteristic. The manners of this Shrimp are exactly those of its congeners, burrowing in the sand, or rather sinking into it, by the rapid displacement of it by means of the false feet.

Class ANNELIDA.

Fam. Amphinomidæ.

Euphrosyne foliosa (Aud. et M.-Edw.). The Leafy Euphrosyne.

A little worm which I presume to be this species, I obtained by dredging in Weymouth Bay, August 9th. The minute antenna at the tip of the caruncle appears to be flattened and trun-